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Original Research Paper

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PREVALENCE AND RISK FACTORS OF COMPUTER VISION SYNDROME AMONG MEDICAL UNDERGRADUATES: A CROSS – SECTIONAL STUDY

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ABSTRACT

Computer Vision Syndrome (CVS) is increasingly recognized as a major Occupational health problem among medical students due to extensive use of digital devices. Medical students still lack sufficient awareness and expertise about CVS, its risk factors and preventive strategies. **Aims and Objectives-** To determine the prevalence and identify risk factors associated with Computer Vision Syndrome among undergraduate medical students. **Methods:** A cross-sectional study was conducted among 355 medical undergraduates using a pre-validated Computer Vision Syndrome Questionnaire (CVS-Q). The questionnaire assessed the presence, frequency, and intensity of 16 ocular and visual symptoms. Demographic details, duration of daily screen exposure, type of digital device used, and preventive practices were also recorded. **Results:** The mean age of participants was 21.34 ± 1.71 years, with males constituting 52.9% of the study population. The prevalence of Computer Vision Syndrome was 57.19%. The most frequently reported symptoms were burning sensation of eyes (65%) and headache (64%), followed by blurred vision (54%), redness of eyes (43%), neck and shoulder pain (38%), and dry eye symptoms (18%). Pre-existing refractive error was observed in 38.9% of students, predominantly myopia (89%). Daily screen time exceeding 6 hours was reported by 58.2% of participants, with smartphones being the most commonly used digital device (92.5%). Poor ergonomic practices were prevalent, including use of devices in a lying posture (61.8%) and non-adherence to the 20-20-20 rule (95.5%). Despite the adoption of preventive measures such as reduced screen brightness, dark mode, and blue-light filters, CVS prevalence remained high. **Conclusion:** Computer Vision Syndrome is highly prevalent among medical undergraduates and is significantly associated with prolonged screen exposure and poor ergonomic practices. Present study highlights the rising digital dependence in medical graduates and identify modifiable risk factors and the necessity of awareness sessions regarding preventive measures and visual hygiene.

KEYWORDS : Computer Vision Syndrome (CVS), Digital Strain, Visual Hygiene, Digital Devices, Screentime

INTRODUCTION

The rapid integration of digital technology into education has transformed learning environments worldwide. Medical education, in particular, increasingly relies on prolonged use of computers, tablets, and smartphones for accessing lectures, electronic textbooks, online assessments, and clinical resources. While digital platforms enhance accessibility and efficiency, excessive and continuous screen exposure has given rise to a spectrum of ocular and visual symptoms collectively referred to as Computer Vision Syndrome (CVS) or digital eye strain[1]. The COVID-19 pandemic further intensified the burden of Computer Vision Syndrome. The abrupt shift to online teaching, virtual lectures, digital examinations, and increased reliance on smartphones and laptops during lockdown periods resulted in a marked surge in daily screen time among students. Medical undergraduates, in particular, experienced prolonged uninterrupted exposure to digital devices for academic activities, often in suboptimal home environments with poor ergonomics and inadequate lighting [16,17] Reduced outdoor activities, limited visual breaks, and increased recreational screen use.

Computer Vision Syndrome is characterized by a combination of visual, ocular, and extra-ocular symptoms, including eyestrain, headache, blurred vision, dryness, burning sensation, watering, diplopia, and musculoskeletal discomfort involving the neck and shoulders [2,3,4,5,6]. These symptoms are typically exacerbated during or after extended periods of near-work on digital screens and tend to improve with rest. The underlying pathophysiology of CVS is multifactorial, involving both visual and ocular surface mechanisms. Sustained near work during digital device use leads to prolonged accommodative effort andconvergence, resulting in accommodative fatigue and binocular vision stress [2,3,4,7]. Uncorrected refractive errors, particularly astigmatism and latent hyperopia, further increase visual demand and contribute to symptom development [8]. Additionally, digital screens often present text with reduced contrast, glare, and pixelated images, requiring continuous micro-adjustments of focus, which intensify visual strain [9,10]. Ocular surface alterations play a central role in the pathogenesis of CVS. Prolonged screen viewing is associated with a significant reduction in blink rate and an increase in incomplete blinking. This leads to tear film instability, increased tear evaporation, and subsequent dry eye symptoms [11]. Environmental conditions, inappropriate screen positioning, and prolonged exposure without breaks further aggravate tear film dysfunction, resulting in ocular discomfort and surface inflammation.

Computer Vision Syndrome is a significant occupational health problem, affecting approximately 60 million computer workers worldwide [2]. Medical undergraduates constitute a particularly vulnerable population for developing CVS due to the nature of their academic curriculum. Long hours of study, frequent use of digital devices for learning and examination preparation, online classes, and recreational screen use cumulatively contribute to extended daily screen time. The demanding academic schedule often limits opportunities for visual rest, while inadequate awareness of proper ergonomics, screen viewing practices, and eye care further increases the risk of CVS [12]. The impact of CVS among medical students extends beyond ocular discomfort. Persistent visual symptoms can negatively affect concentration, reading efficiency, and academic performance. Despite the increasing prevalence of CVS, it remains under-recognized and under-reported, particularly in developing countries, where structured screening and preventive strategies are limited. Understanding the prevalence and associated risk factors of Computer Vision Syndrome among medical undergraduates is therefore essential for early identification, targeted intervention, and implementation of preventive measures. Generating region-specific data can aid in developing evidence-based guidelines to promote healthy digital habits, improve visual

ergonomics, and reduce the burden of CVS in this high-risk population.

MATERIALS AND METHODS

Study Design: A cross-sectional observational study was conducted to assess the prevalence and associated risk factors of Computer Vision Syndrome among medical undergraduate students.

Study Setting: The study was carried out in the Department of Ophthalmology at a tertiary care teaching hospital in northern part of Rajasthan.

Study Duration: The study was conducted over a period of seven months from march 2025 to September 2025.

Study Population: The study population comprised medical undergraduate (MBBS) students from first to final year enrolled at the institution during the study period.

Sample Size and Sampling Technique: A total of 355 medical undergraduate students were included in the study. Participants were recruited using convenience sampling.

Inclusion Criteria:

1. Medical students aged ≥18 years
2. Daily digital device use ≥2 hours
3. Willing to participate with informed consent

Exclusion Criteria:

1. Pre-existing ocular disease
2. History of ocular surgery or trauma
3. Systemic disease affecting vision
4. Unwilling to participate in study or incomplete questionnaire response

Data Collection Tool and Procedure: Data were collected using a pre-tested, structured, self-administered questionnaire developed in accordance with the American Optometric Association guidelines. The questionnaire included demographic details, digital device usage patterns, ergonomic factors, symptoms of Computer Vision Syndrome and validated computer vision syndrome questionnaire (CVS-Q).

The CVS-Q assesses 16 ocular and visual symptoms related to digital device use. Each symptom is evaluated based on frequency (Never [score = 0], Occasionally [score =1], Often[score=2]) and Intensity (Moderate [score = 1], Severe [score = 2]) [13]. The frequency score is multiplied by the intensity score for each symptom, noted and summed to obtain a total score. A total CVS-Q score ≥6 was considered diagnostic of Computer Vision Syndrome [14].

Total CVS score=$\sum$ (Recorded score of all 16 symptoms {Frequency ×Intensity})

All participants underwent a basic ophthalmic evaluation including:

- Visual acuity assessment using Snellen's chart
- Refraction, where indicated
- Anterior segment examination using torch light or slit lamp
- Tear film evaluation (TBUT/Schirmer test)

Outcome Measures

The primary and secondary outcome measures included:

- Prevalence of Computer Vision Syndrome
- Association of CVS with duration of digital device use
- Association of CVS with type of device used

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using SPSS software. Categorical variables were expressed as frequencies and percentages. Associations were assessed using the Chi-square test, with p-value < 0.05 considered statistically significant.

Ethical Considerations:

Approval was obtained from the Institutional Ethics Committee prior to commencement of the study. Written informed consent was obtained from all participants. Confidentiality and anonymity were maintained.

RESULTS

A total of 355 medical undergraduate students were included in the study. Of these, 188 (52.9%) were male and 167 (47.1%) were female. The mean age of the participants was 21.34 ± 1.71 years. Most students belonged to the 21–25-year age group (281; 79.2%), followed by the 18–20-year group (58; 16.3%), while 16 (4.5%) students were aged 25–30 years.

Regarding academic distribution, 92 (25.9%) students were in first year, 98 (27.6%) in second year, 86 (24.2%) in third year, and 79 (22.3%) were in fourth year (pre-final year).

Prevalence of Computer Vision Syndrome

Based on the CVS questionnaire scoring system, the prevalence of Computer Vision Syndrome (CVS) among the study participants was found to be 57.19%.

Symptom Profile of Computer Vision Syndrome

Among CVS-related symptoms, burning sensation of eyes (65%) and headache (64%) were the most commonly reported symptoms, followed by blurred vision (54%), redness of eyes (43%), neck and shoulder pain (38%), and dry eye symptoms (18%).

Among students reporting headache, 59.4% experienced mild symptoms, 18.8% had moderate symptoms, and 4.7% reported severe headache. Burning sensation of eyes was mild in 64.6%, moderate in 9.2%, and severe in 1.1% of affected students. Redness of eyes was predominantly mild (25.6%), with 2.8% reporting moderate and 0.7% reporting severe symptoms. Among students with blurred vision, 42.6% had mild symptoms, 16.7% had moderate symptoms, and 1.5% had severe symptoms. Dry eye symptoms were mild in 90.0%, moderate in 15.0%, and severe in 6.1% of affected students. Among students reporting neck and shoulder pain, 35.0% had mild symptoms, 10.0% had moderate symptoms, and 1.5% reported severe pain.

Refractive Error and Eye-Care Utilization

Pre-existing refractive error was present in 38.9% of students, with myopia being the most common type (89%). A total of 108 students were using spectacles. Regarding eye-care utilization, 70.1% of students had sought ophthalmic consultation in the last three years, while 29.9% had not sought any consultation.

Screen Time and Digital Device Use

More than half of the students (58.2%) reported a daily screen time exceeding 6 hours, while 22.4% had screen time between 4–6 hours, and 19.4% reported less than 4 hours of daily screen exposure. Smartphones were the most commonly used digital devices (92.5%), followed by tablets (50.7%) and laptops (5.9%), with multiple device usage reported by many participants.

Ergonomic Practices and Preventive Measures

With respect to posture during digital device use, 61.8% of students reported using devices in a lying-down position, whereas 38.2% used devices in a proper sitting posture. Adoption of protective measures included use of dark theme (71.0%), reduction of screen brightness (68.0%), and use of blue-light filters (59.7%). Use of digital devices in a well-lit room was reported by 67.2% of students; however, 95.5% reported not following the 20-20-20 rule during screen use.

Break Pattern, Continuous Use, and Purpose of Screen Exposure

Regular breaks during device use were reported by 67.2% of

students. Regarding break duration, 13.43% reported taking breaks of up to 20 minutes, 43.28% reported taking breaks of approximately one hour, while 13.43% reported rarely taking breaks during screen use. Continuous use of digital devices without breaks was reported by 17.9% of students for up to 30 minutes, 17.1% for up to 2 hours, and 11.9% for 4–6 hours.

Regarding the purpose of digital device use, all students reported using digital devices for academic purpose. However, only1.49 % of students reported using digital devices exclusively for academic purposes, while 98.5% reported use for academic purposes along with entertainment, and social media.

Tables – Computer Vision Syndrome Study

Table 1. Demographic Profile of Study Participants

Variables	Number (n)	Percentage (%)
Male	188	52.9
Female	167	47.1
Mean Age (years)	21.34±1.71	

Table 2. Year -wise Distribution of Students

Academic Year	Number (n)	Percentage (%)
First Year	92	25.9
Second Year	98	27.6
Third Year Part I	86	24.2
Third Year part II	79	22.3

Table 3. Prevalence of Computer Vision Syndrome And Associated Symptoms

Parameter	Percentage (%)
Computer Vision Syndrome	57.19
Headache	64
Burning Sensations of Eyes	65
Blurred Vision	54
Redness of Eyes	43
Neck and shoulder pain	38
Dry Eyes Symptoms	18

Table 4. Screen Time Pattern and Digital Device Usage

Variables	Percentage (%)
Screen time > 6 hour/ day	58.2
Screen time 4- 6 hour/ day	22.4
Screen time < 4 hour/ day	19.4
Smartphone Use	92.5
Tablet Use	50.7
Laptop Use	5.9

Table 5. Ergonomic Practices and Preventive Measures

Practice	Percentage (%)
Lying down posture during Device use	61.8
Proper Sitting Posture	38.2
Use of Dark theme	71
Reduce Screen brightness	68
Use of blue light Filter	59.7
Use of well- lit room	67.2
Not following 20-20-20 Rule	95.5

Statistical Analysis of Factors Associated with Computer Vision Syndrome

Association between Computer Vision Syndrome (CVS) and demographic, ophthalmological, and screen-related variables was assessed using the Chi-square test. A p-value <0.05 was considered statistically significant.

There was no statistically significant association between CVS and gender or age group ($p > 0.05$). However, a statistically significant association was observed between year of study and CVS, with higher prevalence noted among students in senior academic years ($p < 0.05$).

Among ophthalmological factors, pre-existing refractive error showed a significant association with CVS ($p < 0.001$). Students with refractive error demonstrated a higher prevalence of CVS compared to those without refractive error. History of ophthalmic consultation in the past three years did not show a statistically significant association with CVS ($p > 0.05$).

A highly significant association was observed between daily screen time and CVS. Students reporting screen time exceeding 6 hours per day had a significantly higher prevalence of CVS compared to those with lower screen exposure ($p < 0.001$). Use of smartphones and multiple digital devices was also significantly associated with CVS ($p < 0.05$).

With regard to ergonomic and behavioural factors, CVS showed a statistically significant association with lying-down posture during device use, non-adherence to the 20-20-20 rule, prolonged continuous screen use, and infrequent break patterns ($p < 0.05$). Use of protective measures such as dark theme, reduced screen brightness, and blue-light filters did not demonstrate a statistically significant protective association with CVS ($p > 0.05$).

Computer Vision Syndrome was significantly associated with prolonged screen time, refractive error, poor ergonomic practices, inadequate break patterns, and higher academic year, while age and gender were not significantly associated.

Table 6. Association of Computer Vision Syndrome with Selected Factors

Factors	CVS Present	CVS Absent	2	P- value	Inference
Gender (Male/Female)	103/100	85/67	0.74	0.39	Not significant
Refractive Error (yes/no)	99/81	23/174	43.6	<0.001	Highly Significant
Screen Time (>6h/<6h)	156/23	45/131	134.53	<0.001	Highly Significant
Posture (Lying/Sitting)	156/90	63/46	1.03	0.31	Not significant
20-20-20 Rule (yes/no)	2/201	14/138	13.7	<0.001	Highly Significant

DISCUSSION

This hospital based, descriptive, cross- sectional study was conducted to determine the prevalence of computer vision syndrome among 355 medical undergraduate students and to evaluate the pattern of associated ocular and extraocular symptoms, digital device usage habits, ergonomic practices and preventive measures related to screen use. Of these 52.9% were male and 47.1% were female with a mean age of 21.34±1.71 year. The present study revealed that computer vision syndrome affected over half of the study participants (57.19%). The present study reflects the finding of previous literature, wherein similar prevalence of computer vision syndrome reported[15]. However, these findings are inconsistent with certain other studies[16,17], which reported higher prevalence rates of computer vision syndrome, Among the affected students, males constituted 29% while female accounted for 28.16%. Although computer vision syndrome was observed slightly more in male students, the association between gender and computer vision syndrome was not statistically significant (^{2}=0.74, df=1, p=0.39) indicating that gender alone may not be an independent determinant of computer vision syndrome in this study population. Similar findings have been reported in previous other studies[18,19,21] which observed no significant gender-based difference in the prevalence of computer vision syndrome. The academic distribution of students showed a relatively uniform representation across different year of medical study, with 25.9% students from the first year, 27.6% from the second year, 24.2 % from the third year and 22.3% from the final year part I. Computer vision syndrome is not confined to a particular academic phase but is a concern throughout the medical study. Therefore preventive strategies and awareness

programmes should be implemented across the all years of medical education. In the present study, burning sensation of the eye was present in 65% of participants. This observation is supported by other research [21], which have documented similar high prevalence of burning of eyes in over half of the participants exposed to prolong screen use reflecting the impact of sustained visual efforts and reduced blink rate on ocular surface health. Barzegari S et al. documented that burning eyes was present in 79% of screen users and Bhammarkar et al. found burning in approximately 50% of university students. In present study, 64% of participants experienced headache, highlighting it as a prominent symptom of computer vision syndrome. The predominance of headache observed in the present study is in agreement with earlier research [1,21,22] which has documented headache in over 50% of participants with computer vision syndrome (CVS). CVS related headaches are primarily attributed to prolonged accommodative efforts, convergence stress and sustained near -work demands associated with continuous screen use [4]. Blurred vision reported by 54% of participants in present study, likely reflects transient accommodative dysfunction and focusing fatigue associated with prolonged screen use [4]. Redness of the eyes, present in 43% of students in present study ,further supports the presence of ocular surface irritation which is likely related to reduced blink rate and increased tear film instability during prolonged screen use[4].The relatively high prevalence of neck and shoulder pain (38%) highlights the role of poor ergonomics and prolonged static posture, indicating that CVS has important extraocular manifestations, as previously reported by logaraj et al.[23] . Interestingly, Dry eye symptoms were reported by only 18% of students in this study, which may be attributed to the younger age group and the predominance of reversible functional strain rather than established ocular surface disease, as noted by Rosenfield et al. study. Overall, these observations reinforce that CVS is a multifactorial condition involving visual, ocular surface and musculoskeletal components, requiring a comprehensive preventive approach.

Pre-existing refractive errors, present in 38.9% of students in present study with myopia being the most common, were associated with higher risk of CVS. These findings are consistent with finding from previous study [23]. The present study demonstrated a significant association between daily screen time and CVS, with students reporting more than 6 hours of screen exposure per day showing a higher prevalence of CVS. This observation is consistent with other previous studies [4,23]. The present study also demonstrated that CVS scores were significantly higher among students who did not follow ergonomic practices and preventive measures such as use of dark mode, reduced screen brightness and maintenance of proper sitting posture and well-lit room. A statistically significant association between poor ergonomic practices and CVS was observed, which is consistent with the finding reported by earlier studies [4,22,23]. Proper workstation ergonomics including appropriate screen height, correct sitting posture and adequate ambient lighting help to minimize excessive accommodative demand, musculoskeletal strain and ocular fatigue. Sheppard and Woffsohn highlighted those preventive strategies such as reducing screen brightness, adopting dark mode where appropriate and taking regular visual breaks can substantially alleviate digital eye strain.

Strength and Limitation of the Study

The strength of the present study is the use of a validated Computer vision Questionnaire and large sample size with participants from all academic year, providing broad representation across different phases of medical study. This study comprehensively evaluated both ocular and extra ocular symptoms along with ergonomic practices and preventive measures, providing a holistic understanding of CVS.

However, certain limitations should be acknowledged. The study was conducted at a single university, which may limit the generalizability of the results to the others settings. Symptoms assessment was based on self -reported responses, which may be subject to under- estimation or over-estimation due to individual perception. Additionally, Objective tear film evaluation tests (such as tear film breakup time or Schirmer's test) were not included, which could have provided a more detailed assessment of ocular surface involvement. Despite these limitations, the study provides valuable insights into the burden and determinants of computer vision syndrome among medical students.

CONCLUSION

The present study highlights that Computer Vision Syndrome is a prevalent and significant health issue among medical undergraduates in the current digital era. A substantial proportion of students experienced computer vision syndrome, with a markedly higher risk observed among those using digital devices more than 6 hours per day. The high prevalence of CVS reflects the growing dependence on digital devices for academic, social, and recreational purposes.

The spectrum of symptoms including visual discomfort, ocular surface irritation, headache, and musculoskeletal pain indicate that CVS affects not only the ocular health but also overall physical well-being. These symptoms may lead to temporary visual (ocular and extra-ocular) complaints, potentially impairing productivity and academic performance.

Furthermore, prolonged daily screen exposure, pre-existing refractive errors, and inadequate adherence to ergonomic and preventive practices were identified as important contributing factors to the development and severity of CVS. Importantly, many of these factors are modifiable, highlighting the need for increased awareness, regular visual screening, adoption of appropriate ergonomic practices and preventive practices such as optimizing screen habits, maintaining proper posture, taking regular breaks, and ensuring timely eye examinations.

Promoting awareness of digital eye health and encouraging ergonomic and preventive practices at an early stage may help reduce the burden of CVS, improve visual comfort, and support better academic performance. Overall, the findings emphasize the need for a comprehensive and preventive approach to address Computer Vision Syndrome in young adults. As digital exposure continues to intensify during medical training, reliance solely on symptom-based assessment may underestimate underlying ocular surface involvement. Further studies incorporating objective tear film evaluation, including parameters such as tear film breakup time and Schirmer's test will be helpful to bridge the gap between subjective symptoms and clinical findings.

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